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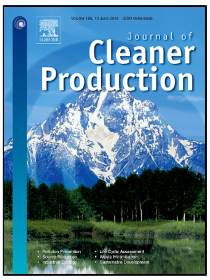


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# Experimenting with decentralized energy governance in China: The case of New Energy Demonstration City Program

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**KEY WORDS**

Governance Experimentation; New Energy Demonstration City Program; Energy Transition; China

**ABSTRACT**

A transition from a fossil fuel based energy system to a more sustainable energy system based more on renewables has been of increasing concern worldwide over the past decade. Such a transition has considerable spatial-physical and socioeconomic implications, suggesting area-based perspectives and related decentralized governance approaches as being crucial to complement, or partly replace, traditional centralized governance approaches. In response to implementation barriers to energy policies, China has also begun to experiment with more decentralized governance structures through the launch of national pilot programs. In the meantime, international studies have disputed the widely assumed benefits of decentralized approaches. Scholars have especially cautioned that decentralization needs to be informed about the degree to which local stakeholders are willing and able to cope with newly acquired responsibilities or tasks. This research investigates the willingness and ability of Chinese local authorities to perform tasks indicated in the pilot program 'New Energy Demonstration City

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(NEDC)'. This research, involving four case study cities and over 20 expert interviews, noted only modest willingness and ability. Local performance is constrained by inadequate local technical and managerial ability and a possible weak profile of renewable energy compared to other local priorities, and a limited local scope of influence over energy transition-related challenges as well decreased local willingness and ability. This research concludes that decentralization under energy policies should take place within a context of central support and stimuli, highlighting the importance of national policies and regulations to enable and activate local authorities and stakeholders in pursuing energy transition policies.

## 1. Introduction

Energy transition has become a global political issue of some urgency and has attracted academic interest as a research subject in the fields of urban and environmental studies (Wassermann et al., 2015). An energy transition can be understood as a transformation of an energy system based on fossil fuels to one that is more efficient and is based on renewables. Such a transition is a highly dynamic, complex and multi-dimensional process in which one dominant socio-technical system transforms into another (Loorbach, 2007; Rotmans et al., 2001). This complex process is "not just a technological issue, but necessarily involves changes across the whole of a society" (Andrews-Speed, 2012, p. 63). More specifically, energy transition is a complex process that cannot be understood within isolated policy sectors. A multitude of interrelated processes are involved, including technological innovations, economic interests, institutions, rules, behaviors, etc. (Verbong and Loorbach, 2012). Hence, an energy transition involves a multitude of societal and market parties, each claiming their place in the governance process. In the meantime, these stakeholders have their own interests, aims, perceptions, and preferences which are interrelated and may conflict with one another (Droege, 2011). Moreover, policy development and implementation manifest themselves differently in different places due to unique local circumstances and interests (Smil, 2008). Therefore, relying on a centralized mode of governing is problematic for managing energy systems as this approach has difficulty in responding to interrelations between energy systems and their physical and socioeconomic contexts in their unique local setting (de Boer and Zuidema, 2016). As a result, authors, such as de Boer and Zuidema

(2015), have highlighted the necessity of area-based approaches to complement existing energy transition policies. In addition, authors, such as Kemp (2010) and van der Schoor and Scholtens (2015), have suggested that the planning and governance of energy transitions needs to embrace and foster the roles that local government, entrepreneurs and citizens can play.

Arguments that support area-based planning approaches are closely linked to policy arguments that support decentralization (Zuidema, 2016) which aim to shift power and responsibility from a national to a local level (De Vries, 2000). Proponents of decentralization have argued that it can increase government responsiveness and effectiveness to local (and more complex societal) issues (Faguet, 2012), while also enabling more productive policy delivery, due to their being a greater knowledge of local circumstances (i.e. needs, potentials and problems) (de Roo et al., 2012). As such, local authorities are thought to be better placed to balance various local interests, power and resources among local actors, market parties, and social organizations (Rumbach, 2016). These widely assumed benefits have placed decentralized approaches at the center stage of policy experiments over the recent decades (e.g., Agrawal and Gupta, 2005; Bulkeley and Castan Broto, 2013; Zuidema, 2016). However, decentralization can also have negative consequences (e.g., Flynn, 2000; Brinkerhoff and Azfar, 2010), for example, limited equity between local governments promoting undesirable competition (De Vries, 2000), free rider problems and increased local corruption (Rees and Hossain, 2010). Meanwhile, authors, for example Smoke (2015), have stated that decentralization can be risky, as decentralized units do not necessarily have the capacity and incentives to act as the theory predicts. As Zuidema and de Roo (2015, p.65) argued, "decentralization means that the outcomes of governance become increasingly dependent on local performance and therefore, of the available local willingness and ability to perform decentralized tasks and responsibilities." Benefits of area-based approaches and a more decentralized governance approach to energy transitions cannot simply be assumed, but need careful studying. This is exactly what this article will do, by targeting one of the most crucial countries in which a global energy transition needs to take place: China.

China is committed to an energy transition towards a low-carbon economy by setting up various policies and targets. Implementation barriers (e.g., Wu et al., 2017) and the expectation of boosting local energy transition have spurred China to experiment with local energy policies with pilot projects, such as Eco-City and Low-Carbon City (18th CCCPC, 2013). These national pilot projects allow local authorities to develop and implement policies according to their specific local circumstances to bring collaborating and competing stakeholders together in a local bargaining network (Li and de Jong, 2017). Although not a replacement for existing central governmental policies and targets, these pilot projects are intended to stimulate local policy formulation. As such, they represent an institutional attempt to experiment with more decentralized practices within the Chinese centralized planning system. Inspired by the aforementioned doubts about decentralization, this article will investigate whether Chinese local authorities have the willingness and ability to develop and implement local energy policies.

Whilst contributing to our knowledge of the current development practices of Chinese energy policies, this article aims also to contribute to a wider debate on energy transitions and decentralized area-based working. Recent studies convincingly have showed the importance of studying energy transitions within their localized spatial contexts (de Waal and Stremke, 2014; Nadaï and van der Horst, 2010; Stoeglehner et al., 2011; Stremke, 2012; Zuidema and de Boer, 2017). The process and practices of the energy transition vary spatially due to the variety of stakeholders involved and the specific local circumstances (Faller, 2016). However, these studies have not explicitly addressed the role of more decentralized energy policies, and therefore this article is contributing to relate energy transitions with decentralization in energy governance. Also, in China, the physical and socio-economic dependence of sustainable energy systems on the local landscape is barely even considered. If studies do address the local level, they have remained focused on the implementation of national policies in a local realm (e.g., Li et al., 2012; Liu et al., 2014; Yang and Li, 2013). Some studies have explicitly raised doubts about local performance (e.g., Khanna et al., 2014; Yu, 2014; Zhang et al., 2010). Nevertheless, these studies have not discussed precisely why local performance is poor, and they have hardly ever reflected on the possible role of the Chinese decentralized

project-based approach (e.g., de Jong et al., 2016). As China works to engage more local energy policy development, this is not just an interesting empirical context for analyzing local willingness and ability, but is also relevant to develop Chinese energy policy. Hence, this article focuses on uncovering the potentials and pitfalls in relation to local willingness and ability to perform the most recent nationwide pilot program: 'New Energy Demonstration City (NEDC)'.

Arguments for and against decentralization are discussed in Section 2 to inform the analytical lens used for the empirical study. Section 3 explains the methodology in which introduces the empirical context of the NEDC program and the cities and is where this article studies its impact in practice. Section 4 discusses the results, noting the modest degree of willingness and ability to develop and implement energy policies at the local level. The main conclusions are presented in Section 5, where this article discusses the role of central policies and incentives for stimulating and supporting local willingness and ability in the realm of energy governance.

## 2. Decentralization in energy governance

An energy system can be viewed as "a complex web of interrelated actors and networks, in physical, social, economic and institutional senses" (de Boer and Zuidema, 2016, p.174). Transforming such a system, thus, involves not only considerable physical and socio-economic changes, but also a multitude of actors and parties with different interests (Verbong and Loorbach, 2012). Relying only on centralized governance modes dictated by governmental decisions and regulations has been viewed as being insufficient (e.g., Pierre and Peters, 2000; Wu et al., 2017). Instead, an energy transition requires a process of governance in which governments, markets and civil society are all involved across various levels and sectors (Loorbach, 2010).

Presently, Chinese energy policies rely on a centralized approach based on regulatory instruments. This is not without its problems, including serious implementation deficiencies at

a local level (e.g., Wu et al., 2017). Inspired by a need to rethink the current hierarchal policy system (e.g., Gilley, 2012), the Chinese central government have chosen to experiment with more decentralized approaches in pilot programs, such as the NEDC. The result is an increase in the inclusion of the local level in developing energy policies; this with the hope of boosting local policy development and area-based solutions. Scholars have pointed out that decentralization can produce more balanced, inclusive and tailor-made policy solutions that are able to respond effectively to interrelated and complex issues (e.g., De Vries, 2000; Mosley, 2009). Nevertheless, the actual outcomes of decentralization depend on local policy performance (e.g., De Vries, 2000; Werlin, 1992). As Zuidema (2016) suggested, local performance depends on local willingness and ability to take on decentralized tasks. Others have added to this that local willingness and ability cannot simply be assumed (e.g., De Vries, 2000; Flynn, 2000; Prud'homme, 1995). Instead, as, for example, Zuidema (2016) states, there are several key constraints to local willingness and ability (also Fleurke and Hulst, 2006). Based on these findings, this article uses the concepts of 'willingness' and 'ability' to discuss the impact of the NEDC.

*Understanding willingness*

Although willingness seems to be a rather straightforward notion, there are at least two crucial nuances that need to be considered when analyzing willingness at an organizational level. The first nuance is drawn from motivation-crowding theory and highlights the difference between willingness based on intrinsic versus extrinsic motivation (Rode et al., 2015; Ryan and Deci, 2000). Intrinsic motivation refers to doing an activity when driven primarily by self-interest or personal conviction (Ritz, 2015). Extrinsic motivation is when activities are driven by external pressure or incentives and are typically done for instrumental value, such as "in order to attain a separable outcome, be it of a material or monetary nature or related to perceived benefits of a non-material kind" (Rode et al., 2015, p.270). The difference between intrinsic and extrinsic motivation is quite relevant in the case of decentralization, as decreasing top-down pressure on local units will imply willingness to become increasingly dependent on intrinsic motivation (compare Bowles, 2008; Zuidema, 2016).

Accepting that motivation-crowding theory focuses largely on individuals fuels the second nuance. This does not imply that the difference between intrinsic and extrinsic motivation is irrelevant for organizational units, such as city governments (e.g., Ritz et al., 2016). Nevertheless, it is crucial to acknowledge that groups function differently from individuals. Organizational willingness might be influenced by existing organizational cultures and routine behavior, constraining the flexibility to adopt new tasks. Furthermore, organizations consist of a multitude of individuals and organizational units. Thus, willingness might differ between units with, for example, one department being highly motivated to pursue certain policies, whilst others resist. In the context of urban governance, such differences might even be amplified, as the organizational environment also includes a multitude of organizations, including companies, citizen groups and lobby groups that all have some leverage on policy development and implementation (Stoker, 1998). In such a fragmented organizational context, identifying willingness needs to be sensitive to 'who' the group is that is willing and how it relates to others that might not.

Investigating local willingness in a context of decentralization should also pay attention to the kind of tasks and government functions that are decentralized (e.g., Fleurke and Hulst, 2006; Prud'homme, 1995). Local units need to perceive tangible benefits when performing such tasks. These can range from financial or economic benefits (extrinsic motivation), to social welfare creation, or even have advantages gained from an ideological or societal value-driven perspective (intrinsic motivation). While energy might well be relevant for all these benefits (e.g., de Boer and Zuidema, 2016), energy also runs a risk of being an issue not directly appreciated as being urgent in a local realm. Zuidema (2016) discussed a similar problem regarding environmental policies in a local realm where he identified this as having a relatively *weak profile*. Some of his examples are also applicable when discussing energy. The benefits of renewable energy are also partly invisible and less tangible (as with global climate change and air pollution). Renewable energy is also facing technological uncertainty (Andrews-Speed, 2012) while an energy transition will require tremendous investments. Apart from the costs of adding renewable production capacity, also many changes are needed

to the many cables, wires, installations or even machinery relying on fossil fuels (e.g. cars, heating systems, housing, shipping, etc.). Even though recent studies have shown that previously high capital cost of renewable energy production have an increased decline and more economic potentials start to emerge (e.g., solar and wind) (Pfenninger et al., 2014), economic challenges thus still remain. Long-lead times and high initial investments needed for the planning and construction of more sustainable energy systems can be competing with the pursuit of short-term economic rewards (Scrase and MacKerron, 2009). In addition, institutional barriers in energy transition still remain with routines and regulations favoring existing fossil fuel based practices remaining relevant (Pinkse and Groot, 2015). So while renewable energy is clearly gaining a stronger profile with regards to its social and economic prospects, it remains realistic that renewable energy ambitions can be eclipsed by priorities that are easier to recognize as being economically attractive policy objectives on local government policy agendas (Andrews-Speed, 2012). Hence, local authorities might be reluctant to deal with the energy transition unless, at least, external incentives are present (e.g., rewards, pressure and prods). Even if there is intrinsic motivation, it is probably still challenging to balance sustainable energy with other policy priorities, as other motives and interests also compete for budget and effort within the wider urban governance arena (e.g., GDP growth, housing and environment). That is: even if fractions of the urban government and society do experience an intrinsic motivation, it is all but evident that the wider urban governance agenda is susceptible to sustainable energy ambitions. Therefore, these risks of renewable energy ambitions are crucial to take into account in empirical analysis.

*Understanding ability*

Ability, first of all, relates to the qualities and characteristics of the local units that have to perform decentralized functions. Prud'homme (1995) highlighted that local units cannot simply be assumed to be equipped with the technical and managerial expertise required to perform a decentralized task. Zuidema (2016) added to this that, next to access to sufficient quantity and quality of staff members, access to relevant tools and technologies (ICT based, computer models, monitoring tools, etc.) are also needed. Furthermore, allowing local units to

invest in, for example, new technologies and equipment, research and development, hiring consultants or attracting new staff can compensate for when abilities are constrained by poor access to financial resources.

In practice, there are often important 'economies of scale' associated with many tasks, where larger (central) government units might have a greater ability in attracting competent staff, for investing in research or for attracting required resources to handle arising and broad ranging policy issues (Prud'homme, 1995; Zuidema, 2016). Hence, there are doubts as to whether smaller (local) units can be sufficiently equipped with equivalent abilities as central governments (e.g., Prud'homme, 1995; Segal, 1997). Economies of scale might be less relevant in this research, as case study cities in a Chinese context often have in excess of one million inhabitants, while the arguments in the literature on decentralization have tended to discuss units (much) smaller than that. Nevertheless, it is also well-documented that (large) cities in China do face common problems, such as inadequate technical resources, unqualified staff (also Gilbert et al., 2013). Hence, as Ostrom (2015) suggested, the central government should support local authorities to overcome potential constraints by supporting their basic needs, conditions and facilities so as to better engage in decentralized policy design. Therefore, when investigating ability, it is crucial to understand how it is influenced by central government support, which, in our case, implies the NEDC policy framework.

The ability to deliver might also be constrained as a transition towards a low-carbon energy system involves several competences that can be highly challenging to (local) governments, amplifying the possible impact of economies of scale. The ongoing transition requires new ways of thinking, working and operating, for example: new technical designs, components and practices to adapt to the new socioeconomic system (Andrews-Speed, 2012). During this transition process, new technologies need to upscale and be embedded in space, grids and businesses. Thus, local authorities need to equip themselves with the *technical abilities* to tackle this challenge. However, transforming the energy system is not merely restricted to developing and replacing technology. Changes in social and institutional rules, like new policies, new relationships between different actors and various domains, and new

organizational structures between departments and within the energy industry, are also needed (Moss et al., 2015). Therefore, this requires an integrated approach that can link cross-sectoral interests, priorities, ideas and the formation of partnership with key stakeholders. Hence, *managerial abilities* are also needed, supported by, for example, professional training systems and collaborations with companies or civil society.

*Scope of influence*

Willingness and ability should not be rigorously separated. After all, when willingness is strongly fragmented in urban governance, there are also practical constraints in being able to successfully govern. A crucial interrelationship between willingness and ability comes forward in what Prud'homme (1995) called 'external effects' and that Zuidema (2016) related to the 'scope of influence'. Both are relevant in the case of energy policies; most notably as it involves issues that manifest on multiple spatial scales. This multi-scalar character tends to result in a limited local sphere of influence over such issues (Ostrom, 2015). This means that local authorities have no or little impact on such issues, since the "decisions of adjacent municipalities or higher-level authorities are also relevant" (Zuidema, 2011, p.118). To illustrate the point in distributed power generation, state-owned enterprises are reluctant to accept major adjustments to the operation of electricity networks in order to maintain their powerful positions in the prevailing market paradigm (Sauter and Bauknecht, 2009). Local new (or small) power enterprises, therefore, are, either shunted from entering the market, or face price competition with large state-owned companies (e.g., Xingang et al., 2012). Decentralization now becomes risky, since all these potential problems can undermine local willingness and ability. An individual local unit alone cannot solve such problems, while the regional, or even national, cooperation is desirable. Thus, investigating willingness and ability again begs for the attention of central policies and cross-jurisdictional coordination.

## 3. Methodology

This study follows a qualitative case study approach, choosing the *New Energy*

*Demonstration City (NEDC)* program as its case, which is introduced in this section. The program provides a context to explore local authorities' willingness and ability in developing decentralized energy policies. To better identify the specific local responses to NEDC program, also four cities within the NEDC were studied in detail. The case selection is presented in this section, as well as the process of data collection and analysis.

### *3.1. Introduction to case program: New Energy Demonstration City (NEDC)*

The NEDC program is the most recently launched program. It operates within a broad variety of different city and development programs that have been introduced by different Chinese ministries, such as *Eco-City (2003), Low Carbon Eco-City (2009) and Low-Carbon City (2010)*. Their common goal has been to improve urban development by incorporating ecological and environmental (e.g., energy) in policy making and implementation. Evaluation of these programs has illustrated that rather broad and fuzzy visions were translated insufficiently into policies and resulted in modest policy success on a local level (e.g., Khanna et al., 2014; Liu et al., 2014). The NEDC program aims to establish more tangible targets, focused directly on the development of local projects in the field or renewables to instigate and support the shift a sustainable urban energy system. The development of a decentralized energy system and the implementation of renewables-based technologies are important foci of the program.

The NEDC program was implemented by the National Energy Bureau (NEB) in 2012 (NEB, 2012), related to the *12th Five-Year-Plan Renewable Energy Development* (NDRC, 2012), which programmed the implementation of 100 New-Energy-Demonstration-Cities until 2015. Those cities were meant to become examples of good practice for other Chinese cities. Local authorities are expected independently to take the decisions and responsibilities for NEDC program implementation. However, the state assumes that decentralization will facilitate better local authorities' responses to locally embedded issues, resulting in more favorable policy outcomes. The NEB encouraged local authorities to volunteer in the program. They especially targeted municipalities with high potential (e.g., natural resources) and ambitions

for participation. Local authorities responded well, due to their prior experiences where volunteering in comparable programs was incentivized by additional national funding, tax benefits, subsidies, program investments, and external cooperation (China low-carbon city construction report, 2014). The plans submitted for the selection committee had expected these to be customized to local circumstances, illustrating innovative strategies. However, previous studies for similar programs illustrated (e.g., de Jong et al., 2016) that developed strategies and implementation actions are often too optimistic about their expected impacts, they over-rate organizational capacities for developing and implementing plans, and they are often very unpractical.

In 2014, 81 cities and eight industrial parks were selected and approved based on the following criteria: (1) by 2012 their share of renewables was more than 3% of total energy consumption; (2) the ratio should have risen to a minimum threshold level of 6% by 2015 (NEB, 2012); and (3) they already showed progress in energy saving and environmental protection, i.e. municipal energy consumption per unit industrial value-added was below the provincial average (NEB, 2014). Initial audits and monitoring showed that "…most cities are having difficulties and low motivation in performing the NEDC program, resulting in an overall very slow rate of progress" (Study of capacity building of new energy demonstration cities, 2016, p.17).

*3.2. Case study cities*

Four case study cities were selected to cover diverse urban conditions, such as geographical location, availability of different natural resources and energy resources, population size and economic performance (Fig.1). A diverse sample allows the investigation of a broad range of different responses to the NEDC program.

**(see attached Fig. 1)**

The two cities on the east coast are economically strong and well developed with active

markets, a strong technical workforce, rich talent pools, and advanced ideas of urban development (China statistical yearbook for regional economy, 2016). Due to their economic strengths, they were expected to be well equipped with resources and have a higher ability to perform. In addition, Yangzhou was specifically interesting, as it has shown increasing interest and ambition regarding renewable energy and already has implemented a diverse range of sustainable energy initiatives and projects. The selection of these two cities was based on the assumption that, if such economically well-performing cities are facing challenges regarding their ability, one might consider the challenges other cities are facing are even more grand.

Dunhuang is a small city in northwest China in Gansu province, which is rich in mineral resources, petrochemicals and electricity generation. Dunhuang is one of the richest areas in China for solar energy, enjoying approximately 3,258 sunshine hours per year and 75% sunshine percentage. Geomorphologically, the surrounding Gobi Desert provides excellent conditions for solar power generation, putting Dunhuang in a frontrunner position for PV and applications (ADB, 2014). Despite the richness in natural resources, economically, it is one of the least developed Chinese regions. Dunhuang represents an opportunity to investigate how resource rich, but economically weak localities respond to the NEDC program. Xi'an is located in the Guanzhong plains in northwestern China with an average economic strength, focusing on manufacturing industries and services. It invests in high tech industries, research and development activities. Xi'an, along with Chongqing and Chengdu, belong to the Western Triangle Economic Zone (the three cities comprised a 40% share of Western China's GDP already in 2009), which is expected to be a major driver for future growth, especially in the high-tech industry (The China Perspective, 2017).

### *3.3. Data collection*

The empirical work is based on an in-depth document and policy analysis drawn from various

Chinese research reports.[2] This analysis provided the basis for the 28 semi-structured interviews conducted in the four city cases between December 2015 and January 2016: Dunhuang (5 interviews), Xi'an (5), Yangzhou (6), and Nanjing (6). The interviewees include journalists, scholars, project managers of energy enterprises, and government officials from different levels of government and different departments related to energy projects: such as planning, economy and environmental protection. Six additional interviews were conducted with representatives from the central government, the National Renewable Energy Research Institute and the Chinese Academy of Social Science in Beijing. Table 1 shows the interview questions. Qualitative data from the interviews were analyzed using content analysis techniques (Krippendorff, 2012).

**(see attached Table 1)**

## 4. Findings and discussion

### *4.1. Limited willingness: a weak profile revealed*

In evaluating the NEDC, Runqing (2015) pointed out the slow development of the program. The interviews confirmed this picture and especially the frustration regarding the expected external incentives and benefits: "(…) by far we have not yet received any financial allocation, tax benefits or rewards policies from the central government'' (NJ03, 2016). The NEDC triggered and motivated local authorities and stakeholders with the promise of financial incentives. Prior experiences with comparable programs that were heavily incentivized (e.g., Low-Carbon City) amplified the expectations and the extrinsic stimulus to participate (BJ03, 2015). The missing external stimulus now undermines the local willingness of NEDC implementation. Consequently, intrinsic motivation has become dominant, which, in practice, was often limited to using the NEDC label merely to add to city branding to attract external investors and companies (BJ02, 2015). This phenomenon, in particular,

[2] China renewable energy industry development report, 2014; China low-carbon city construction report, 2014; and Study of the capacity building of new energy demonstration cities in China, 2016.

happened in larger cities, such as Nanjing and Xi'an: "The energy transition itself actually holds little attractions for us, since it can only contribute a small proportion to local GDP" (NJ04, 2016). This might be due to the Chinese so-called GDP-ism, where GDP growth is the overriding policy goal (Table 2). This corresponds with earlier research results (Jia et al., 2015). Under high political pressure, local authorities prioritize policy targets and measures that can propel economic development. Additionally, governing the energy transition is a long-term pursuit, which sometimes conflicts with short-term priorities, e.g., GDP improvement. The NEDC program, as part of this transitional aim, requires significant investment but "(…) has a long payback period and unstable earnings" (XA03, 2015). The weak profile of sustainable energy ambitions indeed undermines intrinsic motivations. Combined with the non-appearance of external benefits, the NEDC has become mere 'window dressing' with minor impacts. This outcome also resonates with work from Gneezy et al. (2011) who showed that low or insufficient extrinsic incentives could lower the willingness and increase the risk of implementation deficiencies.

**(see attached Table 2)**

Compared to Xi'an and Nanjing, Dunhuang and Yangzhou showed more intrinsic motivation for NEDC implementation. In Dunhuang pushing for renewable energy is even a citywide mission, supported by considering it a key economic opportunity for the city. With Dunhuang thus shown the rise of renewable energy as a possible opportunity to support GDP growth, the other cities were different. Even in Yangzhou renewable energy was largely limited to the energy department. The Yangzhou energy department's stated vision is to improve the livability and sustainability of the city as a result of the energy transition, and considered the NEDC program as a welcome opportunity to realize this vision (YZ02/03, 2016). However, the size of the group and enforcement power hampered their possibility to push the agenda, design and implement projects and, therefore, they missed the reinforcement, internal satisfaction and social recognition (Rode et al., 2015) for their efforts to implement the NEDC program. For example, the energy department of Yangzhou suggested renewables were integrated into old communities and new buildings, which was also drafted in its NEDC plan

(Table 3). However, this planned measure encountered limited support from other related governmental sectors, such as the housing department: "We are reluctant to shoulder the retrofit costs alone, which can also be an extra administration burden for us" (YZ05, 2016). Similarly, as respondents in the economic department stated, "sustainable energy could not bring us immediate economic growth, along with nothing in financial support…this issue is then hard to be taken seriously" (YZ01,2016). Conflicts of interests and alternative policy priorities constrained overall local willingness for pursuing NEDC ambitions.

**(see attached Table 3)**

The cases suggest that relying on intrinsic motivation alone currently might not be sufficient for pushing forward urban renewable energy initiatives. Even among the participants of the NEDC, the role of assumed (financial) benefits dominated over intrinsic motivation. Facing no such benefits, only two cities show evidence for motivation, while in Yangzhou, this motivation is limited to merely the energy department. With these cities likely being amongst the more proactive cities, it is unlikely the overall picture of motivations for renewable energy projects is larger in the majority of Chinese cities. Hence, even when decentralized working can add value, the results suggest that a degree of top-down pressure does remain crucial to create sufficient extrinsic motivation.

*4.2. Technical and managerial ability*

Although all four cities' plans are in the NEDC application phase with ambitious targets and measures (Table 3), all lacked ideas about how exactly to implement these plans. They not only have difficulties translating strategic ambitions into practical tools and projects, but also experience difficulties integrating energy ambitions into local sectoral plans. The respondents pointed out that an energy transition requires many new competences, such as cross-sectoral working, designing long-term policy, reorganizing governance structures, creating new institutions, new technological skills and substantive expertise. They all considered

themselves ill equipped to address these challenges, lacking 'sufficient expertise' (Table 2). Notably, the respondents noted problems of limited staff, resources, and expertise, causing local authorities to often struggle with program implementation. The eastern, and thus richer cities (i.e. Nanjing and Yangzhou), did show a stronger ability regarding, for example, talent attraction and funding (see Table 2). Nevertheless, even these cities considered themselves to be only partly equipped, at most. Nanjing and Yangzhou still reported that their managerial and organizational abilities were too modest to fully develop cross-sectoral and integrated approaches and to forge convincing and sustainable partnerships with involved stakeholders. In doing so, several local representatives also referred to their relative small capacity to attract funds and expertise, as compared with the central government; indeed suggesting economies of scale mattered even for these larger local units.

The western cities faced the most severe problems. A national expert indicated, "ideas and behavioral patterns in western cities still remain in the era of planned economy. They used to expect and wait until the central government tells them what and how to do. It seems very difficult for them to link actively local energy resources to the policymaking of urban development" (BJ01, 2015). For example, respondents in Xi'an perceived that they found it hard to find sufficient quantity and qualified expertise in the design of NEDC plan. Instead, policy-making relied largely on a few implementing governmental officials (XA05, 2016). Next to finding limited technical experts, Xi'an also complained about limited skills in integrated working:

> "We have not found qualified staff that can help us make plans in an integrated way, considering energy transition in other social aspects (e.g., environment, economy). We once tried to cooperate with local universities and research institutes, but mostly are focusing on technology use at a given renewable energy resource (e.g., solar, wind or biomass) instead of thinking in a holistic and comprehensive way. We do not believe that making the project successful can only rely on exploration by a few of us sitting in government offices" (XA01, 2016).

Severe problems were also encountered in Dunhuang. As a resource-rich, but economically

weak city, the municipality viewed NEDC as a city mission and an opportunity to expand its already limited economic development channels. Therefore, Dunhuang established a management office to act as the implementing agency specifically for NEDC program. However, its high willingness could not guarantee the take off and Dunhuang noted severe constraints in technical and managerial expertise. Additionally, there were no distinct policies in place to hire specialists and to invest in research funding for NEDC. These findings align with the ADB report, "Gansu Province showed strong interest in the timely implementation of the program in its selected cities of Dunhuang…but highlighted capacity gaps in implementing the program" (ADB, 2014, p.3). Clearly, with even the richer eastern cities being constrained, success of the NEDC also would depend on national government support in the form of, for example, staff, funding, training or expertise. Again, decentralization should not be seen in isolation from central governmental roles and responsibilities.

*4.3. Scope of influence*

Finally, all four cities face serious renewable energy (RE) challenges that are beyond their scope of influence (Table 2). One problematic example is the RE power grid integration issue. Although the power sector reform in China has been ongoing for several years, the current power market is still deeply rooted in the planned economy and administrative monopolization (Kahrl et al., 2011). While the market for power generation is open to the private sector, the power grid is state-owned and holds a monopoly on transmission, distribution and supply of electricity, i.e. controlled electricity purchase and sale. The State Grid Corporation owns and controls 88% of the regional and inter-regional transmission lines in China (China's energy system reform report, 2014) and grid feed for private companies is limited and subject to state control.

Also, the central government sets energy prices. Thus, even if cities implement projects and increase their RE share, the possibilities for further development can be limited due to restricted grid access: "Local private, especially small, renewable energy companies barely have room to negotiate with the state-owned grid companies regarding grid integration, while

we municipalities do not have the right to make any reforms to the current power system" (NJ01, 2015). A project manager in an energy enterprise remarked that, "Energy companies in China now failing to connect to the grid are nearly all local private companies" (BJ05, 2016). Hence, energy project investors and developers are gradually losing their enthusiasm and willingness to fulfill the project implementation: "… (the) Chinese power sector does need a reform" (XA02, 2016), and "Open the power market and allow the sale of electricity to the private sector, and formulate market-oriented energy pricing systems" (YZ04, 2016).

Failure to integrate RE into grids further hinders an energy transition: Western Chinese cities are experiencing high levels of renewables curtailment. A nationwide report revealed "(…) there was more than 30% of wind power and solar power curtailment in Gansu Province and Xinjiang Autonomous Region in 2015, even more than 50% in some months" (CREO, 2016, p. 30). The implication here is that many power producers, such as solar panels and wind turbines, stop generating power even when they can, thereby resulting in huge renewable resources being largely wasted. This is notably problematic in Dunhuang, which produces excess energy due to its low self-consumption, but high RE energy production. Therefore, it is pinning its hope on transmitting its redundant electricity to other Chinese areas with high electricity demand, such as cities in the east. However, these cities prefer local fossil-fuel power, or their own renewable potential, rather than to purchase from trans-regional markets in consideration of local economic benefits and in support of their own RE companies.

This creates additional issues that are outside of their local scope of influence: (1) for Chinese local governments, fossil-fuel generation is still the primary source of tax revenues and employment; (2) RE power has no price advantage, as China's RE price is set by central government and is close to the fossil-fuel price, but it rises once REs are transmitted to other electricity demand regions (transmission costs are counted); and (3) Chinese central government still maintains guaranteed quotas for fossil-fuel electricity generation, the priority source of generation. Meanwhile, there are no mandatory quota regulations on regional grids to integrate RE electricity, leaving RE struggling to compete. "We feel anxious that our mass renewables production struggles to be transmitted to the outside and thus are wasted," (DH03,

2015) was one concern voiced in Dunhuang. Clearly, a larger, and even national level, reform of policies on Chinese power sector would be needed to boost local willingness and ability.

## 5. Conclusions

In the face of failures to implement some previous national energy policies, the choice of the Chinese national government to experiment with more decentralized working seems both relevant and promising. Notably, in urban contexts where the spatial implications of renewable energy are both vast and easily contested, such decentralized working might be crucial in negotiating possible societal resistance and activating local (economic) spin-offs. But, while area-based and decentralized working both seem sensible, if not crucial, local willingness and ability are not evident. Local performance is strongly constrained by inadequate local resources and abilities, and meanwhile, except for the case of Dunhuang, renewable energy does not face much local willingness. Despite its rapid increase in popularity a raising financial benefits, renewable energy does not yet show itself to be a mainstream policy priority. Even if it does, as in the case of Dunhuang, the wider national institutional setting and the limited scope of local influence still frustrates a rapid take-up of renewable energy. Renewable energy might be gaining a much stronger profile, but our study suggests it is currently not yet strong enough to capture the full attention and support of local authorities. Thus, integrating more local policy development and implementation in the energy transition should not ignore the role of (inter) national policies to enable and activate local authorities and stakeholders in pursuing energy transition policies (also De Vries 2000; Prud'homme, 1995; Zuidema, 2016).

For the NEDC, only limited national support existed. There were no supportive and external stimuli in place to motivate local willingness. This suggests that future success would demand such incentives, for example, financial resources or flexible regulatory pressure. Currently, the pilot projects run a serious risk of becoming mere campaign slogans. These could also ask for performance-monitoring mechanisms, or more binding contracts or covenants between central government and municipalities participating in programs, such as the NEDC. Rewards

and pressure, in combination with monitoring local performance, can incentivize local action and promote cooperation between various organizational units.

Apart from putting pressure on willingness, the limited technical and managerial expertise seems even more urgent. While the literature on decentralization warns about economies of scale for smaller local units, the current pursuit of energy transitions puts even larger local units at risk. The size and complexity of such a transition, combined with novel technological skills, seem to be too grand for even cities of eight million inhabitants. Apart from suggesting some degree of national support, the situation also clearly illustrates how ill-equipped many current governance systems still are in the face of the physical, economic and institutional challenges of a significant energy transition.

Nevertheless, some degree of central government support could alleviate the challenges. They can help local authorities (especially smaller/western cities like Dunhuang) through guidance, training and offer them expertise, ideas and experience to deal with new tasks. Moreover, central government can balance regional differences through its national administrative capacities; for example, by allocating talent resources from eastern Chinese cities to western cities for a period to provide much-needed professional and advanced ideas and knowledge. Furthermore, it is necessary for the central government to set up effective regulatory frameworks to drive and enable RE development and electricity market reform. Doing so could spur local private energy companies and related stakeholders to get involved in the Chinese energy transition.

Finally, it is important to note that this research findings might be based only on the Chinese situation, but that they explicitly resonate with existing international research findings and debates on decentralization. This suggests that this research findings might well be more widely applicable if not simply evidence of some fundamental characteristic of decentralization: local willingness and ability to take over decentralized responsibilities and tasks can easily be constrained and lacking. As such, this research findings serve as a clear warning for alternative policy contexts where more decentralized working is sought after

within the energy transition. Technical and managerial ability, the possible weak profile of energy vis-à-vis other local (financial) priorities and a limited local scope of influence over crucial causes of existing challenges simply need to be assessed and addressed before and while pursuing decentralization. In the meantime, this research also confirmed that when celebrating the importance of local initiative and involvement in energy transitions through area-based working, there remains a critical need for national policies and regulations; not only as some issues are simply better dealt with at a higher level, but also to enable, support and stimulate local action and area-based solutions. After all, local willingness and ability cannot simply be assumed, certainly not when it comes to the NEDC.

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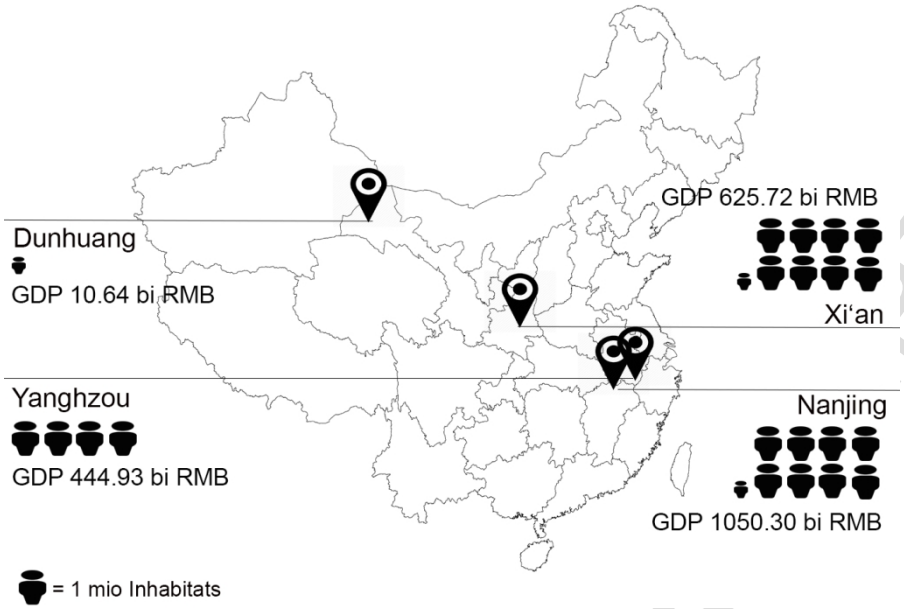


**Fig. 1.** Location of the four case studies (*Source*: Authors)
Note: GDP is based on the year of 2016

**Table 1**

Analytical framework, translated into the guideline interviews

| Potential constraint | Guiding questions |
|---|---|
| Willingness | • What is the driving force of applying for the program? (intrinsic and extrinsic motivation)<br>• How important are energy issues as compared to other local policy priorities (e.g., GDP growth, environment)?<br>• How is willingness spread among departments and stakeholders? |
| Technical and managerial ability | a) Technical ability<br>• Do you consider your city has sufficient technical expertise?<br>• Are there funding and subsidies available to support the implementation of NEDC program?<br>• How does your city attract needed expertise from different fields?<br>• Are there other supportive polices in your city?<br>b) Managerial ability<br>• Do you consider your city has sufficient managerial expertise to develop and implement energy plans and projects?<br>• Are there training systems in place?<br>• What instruments/tools are used to discuss and balance interests with stakeholders? |
| Scope of influence | • What struggles are encountered that local authorities can hardly influence? |

**Table 2**

Overview of mapped local willingness and ability to NEDC implementation

| Indicators | Details | Dunhuang | Xi'an | Nanjing | Yangzhou |
|---|---|---|---|---|---|
| Willingness | Extrinsic motivation dominant | × | √ | √ | √ |
| | Serious degree of intrinsic motivation | √ | × | × | √ |
| | Urban wide willingness (as opposed to limited to small group of actors / departments) | √ | × | × | × |
| | Energy transition is considered as a crucial policy issue, compared to the importance of GDP as policy priority | × | × | × | × |
| Technical and managerial ability | **Technical ability** | | | | |
| | Sufficient expertise | × | × | × | × |
| | Special funding and subsidies | × | × | √ | √ |
| | Talent attracts policy | × | √ | √ | √ |
| | Other supportive polices (e.g., projects subsidies, rewards, legal instrument) | × | √ | √ | √ |
| | **Managerial ability** | | | | |
| | Sufficient expertise; notably integrated approaches and working across departmental and governmental organizational borders | × | × | × | × |
| | Training system | × | × | × | × |
| | Tools setting to discuss and balance interest among stakeholders | × | × | × | × |
| Scope of influence | Mismatch between spatial and administrative scales | √ | √ | √ | √ |

*Source: Interviews 2015/2016*

**Table 3**

Key measures and targets in four case studies' NEDC plans

| City | Targets (share of renewables in energy consumption) | Key planned measures |
|---|---|---|
| Dunhuang | 27% | • Micro Grid project:11,640kw<br>• Concentrating solar power (CSP) and combined heat and power (CHP): 145mw<br>• Solar PV and wind power generation: 3000mw<br>• Solar hot water project: 10,000m2<br>• Solar house project: 14,000m2<br>• Electric vehicle project (EV): 430 vehicles |
| Xi'an | 6.4% | • Solar hot water and wind power generation projects<br>• Solar water heater systems and solar lighting in new developing areas<br>• Develop biomass power generation projects in urban and rural areas |
| Nanjing* (Jiangning district) | 6% | • Solar PV:50mw<br>• Waste power generation project: 44mw<br>• Biomass power: annual generating capacity reaching 30 million kwh<br>• Wind power: 100mw wind farm<br>• EV: 2 EV bus charging stands;1400sm battery charging stations |
| Yanghzou | 8% | • Promote solar water heater systems in existing buildings<br>• Integrated renewable energy (RE) in historical old towns<br>• Geothermal application in residential communities and all new public buildings<br>• Develop 30 integrated RE community demonstration: installing rooftop and wall-mounted solar water heaters, ground source heat pump cogeneration, solar PV, garbage biogas ,etc.<br>• 'Smart valley' demonstration base: RE application education and training bases to show major RE use projects |

*: Nanjing municipality selects Jiangning district as the pilot area for NEDC project

*Source: Fieldwork; NEB (2012)*